



Testimony
of

SAM BLAKESLEE
California State Senate
District 15

before

**THE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE**

April 12, 2011

I am a California state senator who represents the 15th District on the Central Coast. For the previous six years I was the State Assembly Member representing the 33rd District and served as Republican Leader immediately prior to being elected to the State Senate. I am a former research scientist who earned bachelors and masters in Geophysics from UC Berkeley and a Ph.D. for earthquake studies at UC Santa Barbara. I worked for Exxon as a research geophysicist and later as a strategic planner at their research lab in Houston Texas. I live with my wife and two young daughters in San Luis Obispo, 8 miles from Diablo Canyon, one of two operating nuclear power plants in the state of California.

The seismic setting of the Diablo Canyon site has been a source of well-documented controversy for more than four decades. In 1967, the operator of Diablo Canyon, Pacific Gas and Electric (also known as PG&E) stated in their initial permit application the site had only "insignificant faults that have shown no movement for at least 100,000 and possibly millions of years." Four years later in 1971, researchers discovered the Hosgri fault about three miles offshore, which the USGS estimates is capable of a magnitude 7.3 earthquake. This significant discovery led to major seismic retrofits. In 1981, PG&E realized that the retrofit blueprints had been reversed – structural supports that were meant for one reactor were actually built for the other reactor. In the end, it took 15 years and more than \$4.4 billion in cost overruns before the plant was operational.

After reviewing the geophysical work performed by PG&E, I became increasingly concerned that they did not appreciate the potential complexity of the seismo-tectonic setting of major fault blocks near the plant. Upon being elected to the California legislature in 2005 I called on my local utility to use more sophisticated geophysical methods to assess the complex seismic setting on the coast. My experience as an industry scientist had allowed me to become intimately familiar with the power of 3D seismic imaging techniques to directly image complex fault systems, particularly in marine settings.

PG&E's response to my call was a column written by the nuclear power plant's vice president stating, "Freshman Assemblyman Sam Blakeslee's proposed legislation to conduct another seismic study of Diablo Canyon... is unnecessary and bad policy for our California customers".

I then drafted Assembly Bill 1632, which was passed by the California legislature and signed by Governor Schwarzenegger in 2006, which directed the California Energy Commission to perform their own independent review the data and to assess the potential seismic vulnerability of the state's nuclear power plants and to provide recommendations. That same year PG&E moved to initiate the process to relicense the nuclear power plant though there was no compelling need to rush the process as their current licenses last through 2024 and 2025.

While the California Energy Commission was being performed a Magnitude 6.8 earthquake struck Japan in July of 2007. The shaking far exceeded what the Japanese utility expected was possible for the offshore fault and the largest nuclear power plant in the world was badly damaged. Today, nearly four years later, 3 of the 7 reactors remain offline with cumulative energy replacement costs in the billions.

In 2008, the California Energy Commission issued their report, pursuant to AB1632, which stated that the uncertainties did in fact exist near the Diablo Canyon Nuclear Power Plant, and that 3D seismic studies were recommended. PG&E's written response to the Commission was, I quote, [we] "believe there is no uncertainty regarding the seismic setting and hazard at the Diablo Canyon Site".

Mere weeks later, the US Geological Survey discovered the Shoreline fault running within some hundreds of yards offshore from PG&E's nuclear power plant and with an orientation that could potentially intersect with the powerful Hosgri fault.

Within days, PG&E declared, "We don't see anything that exceeds the plant's design basis." This statement was made before having completed any of the necessary analysis to determine the precise location, length, and relationship to the dangerous Hosgri fault. The USGS scientist who discovered the fault, in conversations with me, expressed her deep concern that PG&E would rush to make these assertions prior to completing the necessary research to determine the facts.

In a California Assembly hearing as recently as 2009 PG&E stated "we're willing to go to the 3D, but right now we just don't think you jump right there as the prudent thing to do". This foot dragging on acquiring the necessary seismic data has continued; all the while, PG&E has moved rapidly to finalize relicensing with the Nuclear Regulatory Commission.

Fast forward to the events of this last month, when yet another Japanese earthquake struck. This time, a 9.0 magnitude earthquake struck offshore Japan on a fault system believed capable of a 7.9 magnitude quake. This massive earthquake caused explosions at three reactors at the Fukushima Daiichi Nuclear Power Plant. Like the 2007 Chūetsu earthquake, the Tōhoku earthquake far exceeded both the seismic and engineering assumptions. The devastating series of unexpected events revealed unknown vulnerabilities at the nuclear facility and their backup safety systems.

Professor Akira Omoto of the Japan Atomic Energy Commission, who was involved in the construction of the Fukushima Daiichi nuclear facility, admitted that the engineering assumptions and redundant failsafe systems believed by experts to guard against a nuclear disaster, in the end, simply proved inadequate. "We thought we had taken adequate precautions... but what happened was beyond our expectation." Despite having filed with the California Public Utilities Commission to obtain authorization for ratepayer funding for seismic studies that included an offshore 3-D survey, PG&E recently told local press that it is still evaluating whether to complete the studies.

Three weeks ago the California Senate held a hearing on the Japanese earthquake, tsunami, and resulting nuclear crisis. I asked PG&E directly if they still continued to support their earlier assertion to the California Energy Commission that there was no uncertainty in the seismic setting near the plant. PG&E responded by saying that although there is always some uncertainty they had no concerns about that uncertainty. Under repeated questioning they said that they were not concerned about the uncertainty.

In the wake of their repeated denials regarding any seismic uncertainty, their denial of any concerns, their documented resistance to acquiring necessary geophysical data, their premature assertions that all is safe without first obtaining the necessary data to support their conclusions, their rush to relicense a dozen years before their current licenses expire, and the tragic events producing the damage and destruction of two coastal nuclear plants due to two separate offshore earthquakes, I asked that PG&E suspend or withdraw its license application with the NRC until the seismic data is in hand to allow regulators to make informed decisions. They refused to answer my question at the hearing but said they would get back to me. I followed up a week later and called asking for a meeting with their President to discuss the issue. They

refused to allow the meeting to occur. They have not yet responded to my request. That is why I am here today to seek your help as the utility appears determined to race to re-licensure before the seismic data can be acquired and analyzed.

We are at a critical juncture in California. In the aftermath of the two Japanese earthquakes and nuclear accidents policymakers have a duty to ensure that state and federal regulators have all the necessary data to make informed decisions regarding the conditions of re-licensure for California's two coastal nuclear power plants.

Failures by federal and state regulators to provide adequate independent oversight and responsibly enforce appropriate safety measures has recently led to catastrophic human and environmental disasters in the past

The Deepwater Horizon Gulf oil spill, the most significant environmental tragedy in the history of the nation, was attributed by experts as both an industry and governmental regulatory failure. Mineral Management Services adopted a passive check-the-box mentality and failed to provide rigorous oversight.

And here we face another potentially threatening scenario, yet again, with Diablo Canyon confirmed by federal regulators as one of two nuclear power plants in the highest risk seismic areas in the nation. It is unquestionable that there remains significant uncertainty about the seismic potential and risk around Diablo Canyon Nuclear Power Plant, and this uncertainty is of great concern to the California local and state regulators and authorities. In recent years, elected officials and regulators with oversight responsibility have reiterated requests that PG&E first conclude the necessary seismic work prior to pursuing relicensing. The data that would be collected from these studies must be available to the Nuclear Regulatory Commission before the relicensing application process is completed. As the current operating licenses for Diablo Canyon are valid through 2024 and 2025, we believe that there is more than sufficient time for advanced seismic studies and review to be properly performed. Relicensing prior to the completion of this rigorous analysis would be premature.

It is our sincere hope that PG&E will earn the trust of local residents, regulators, and elected officials by voluntarily withdrawing or suspending its re-licensing activities until the geophysical has been completed. If PG&E will not voluntarily do so, I would request that this body direct the NRC to suspend its consideration of PG&E's application until it has received the critical information it needs to make a thorough and responsible decision.

Preliminary Findings and Lessons Learned from the 16 July 2007 Earthquake at Kashiwazaki-Kariwa NPP

Excerpts from the International Atomic Energy Agency, *Mission Report: Volume 1*

Available online at: http://www.iaea.org/newscenter/news/pdf/kashiwazaki060807_vol1.pdf

Background (p. 3)

Kashiwazaki-Kariwa nuclear power plant is the biggest nuclear power plant site in the world. It is operated by Tokyo Electric Power Company (TEPCO). The site has seven units with a total of 7965 MW net installed capacity. Five reactors are of BWR type with a net installed capacity of 1067 MW each. Two reactors are of ABWR type with 1315 MW net installed capacity each. The five BWR units entered commercial operation between 1985 and 1994 and the two ABWRs in 1996 and 1997 respectively.

At the time of the earthquake, four reactors were in operation: Units 2, 3 and 4 (BWRs) and Unit 7 (ABWR). Unit 2 was in start-up condition but was not connected to the grid. The other three reactors were in shutdown conditions for planned outages: Units 1 and 5 (BWRs) and Unit 6 (ABWR).

A strong earthquake with a moment magnitude of 6.6 (MJMA=6.8 according to the Japanese Meteorological Agency) occurred at 10:13 h local time on 16 July 2007 with its epicentre about 16 km north of the site of the Kashiwazaki-Kariwa NPP and its hypocentre below the seabed of the Jo-chuetsu area in Niigata prefecture (37° 33' N, 138° 37'E).

The earthquake caused automatic shutdown of the operating reactors, a fire in the in-house electrical transformer of Unit 3, release of a very limited amount of radioactive material to the sea and the air and damage to non-nuclear structures, systems and components of the plant as well as to outdoor facilities, as reported by TEPCO on their web page.

Preliminary data indicated that the design basis ground motion for the plant may have been exceeded, with possible significant effects on the behaviour of the plant systems, structures and components.

Exceedance of the Design Basis Ground Motion by the Observed Earthquake (p.8)

Comparisons of the seismic response spectra used for the design of structures, systems and components with the response spectra that were obtained from the time histories recorded by the installed site accelerometers during the 16 July 2007 Niigataken Chuetsu-Oki earthquake show that at the base mat elevation (which is considered as input for the seismic analysis) there is significant exceedance of the design basis levels by the observed values for a very wide range of spectral frequencies.

In spite of the exceedance of the seismic input, from the presentations made by TEPCO experts as well as from reports by the regulatory authority (NISA), and as was confirmed by the plant walkdowns performed by the IAEA team, it is indicated that the safety related structures, systems and components of all seven units of the plant (in operating, start-up and shut down conditions) demonstrated good apparent performance in ensuring the basic safety functions concerning control of reactivity, cooling and confinement.

Therefore, it is important to understand all the elements involved in the derivation of the seismic design basis and identify the sources of conservatism as well as sources that contributed to the exceedance of the seismic design basis by the observations from the earthquake. The chain that makes up the process of the derivation of the seismic design basis and the actual design of the plant structures, systems and components has a multitude of links that have varying degrees of uncertainty and that are evaluated by earth scientists, hazard analysts, geotechnical, civil, mechanical, electrical and systems engineers. As the design basis response spectra and thus the seismic design are composite products, a systematic approach is needed for this process to identify the sources of uncertainties and conservatisms.

Exceedance of the Design Basis Ground Motion by the Earthquake (p.13)

Recent studies for the evaluation of seismic hazard for new and operating nuclear facilities have consistently shown significantly higher values compared to those evaluated in previous decades. Also in the past two years, two nuclear power plants in Japan experienced earthquakes that exceeded the design basis response spectra without any damage to safety related structures, systems and components.

As a result of this, the IAEA started an extra-budgetary programme on the seismic evaluation of existing nuclear power plants (hazard and design evaluation) supported by, among other Member States, Japan where TEPCO is a major contributor. Therefore, although the 16 July 2007 Niigataken Chuetsu-Oki was a major earthquake that exceeded very significantly the design basis response spectra of the plant at the base mat level, its occurrence was not totally unexpected by the plant because of the awareness brought by earlier events and the related ongoing international interaction.

When there are significant contributions to the seismic hazard by active faults in the site vicinity or the near region (see the IAEA Safety Guide NS-G-3.3 for definitions of the terms site vicinity and near region), source parameters such as the fault mechanism and directivity effects may play an important role. This may cause variations in the hazard even within areas very close to each other. Ways of including these effects in seismic hazard studies need to be considered when such active faults are present in close proximity to NPP sites.

Need for strengthening of the database to decrease uncertainties (p.18)

A significant amount of investigations both on land and offshore are foreseen in the upcoming programme for the re-evaluation of the seismic hazard at the Kashiwazaki-Kariwa nuclear power plant site. It is expected that these investigations will provide information relating to the identification and the characterization of the faults in the region. This would significantly enhance the geological database and help in reducing uncertainties regarding their existence, location and characterization.

Faults in the near region (p.18)

The faults in the near region of Kashiwazaki-Kariwa nuclear power plant site will also be of interest for the modelling of the attenuation relationship and how new methods such as empirical Green's functions can be applied within the context of a nuclear power plant seismic hazard evaluation. Source related parameters such as fault mechanism and directivity were observed to play an important role in the recent earthquake. It is expected that new methods may provide more information relating to these issues.

An Assessment of California's Operating Nuclear Power Plants: AB 1632 Report

Excerpts from California Energy Commission (2008), *An Assessment of California's Operating Nuclear Power Plants: AB 1632 Committee Report*, CEC-100-2008-108-CTF

Available online at: <http://www.energy.ca.gov/2008publications/CEC-100-2008-009/CEC-100-2008-009-CMF.PDF>

Executive Summary (p. 1)

Assembly Bill 1632 (Blakeslee, Chapter 722, Statutes of 2006) directs the California Energy Commission (Energy Commission) to assess the potential vulnerability of California's largest baseload power plants, which are California's two operating commercial nuclear power plants, to a major disruption due to seismic event or plant aging. The Energy Commission is directed to adopt this assessment on or before November 1, 2008, and include it in the 2008 Integrated Energy Policy Report Update (2008 IEPR Update). The legislation also directs the Energy Commission to assess the impacts that such a disruption would have on California's energy system reliability, public safety, and the economy; assess the costs and impacts from nuclear waste accumulating at these plants; and evaluate other major policy and planning issues affecting the future role of these plants in the state's energy portfolio. AB 1632 also requires updates of the seismic vulnerability assessment to be performed as part of future Integrated Energy Policy Reports and that these updates take into account new data or new understandings of seismic hazards for these plants.

Seismic Hazards at Diablo Canyon (p.3-5)

The offshore Hosgri Fault zone, 4.5 kilometers west of Diablo Canyon, creates the primary seismic hazard at the plant site. Over the years there has been uncertainty regarding the tectonic setting of this fault zone, and the characterization of the Hosgri Fault as either a lateral strike-slip fault or as a thrust fault. The distinction is significant for the ground motion hazard at the Diablo Canyon site: a strike-slip fault is steeply (i.e. close to vertically) inclined, and a thrust fault has a shallower angle and extends diagonally beneath the surface. If the Hosgri Fault were a thrust fault with an eastward dip, the fault would extend closer to the Diablo Canyon site, and the ground motion from an earthquake could be greater.

Another potential seismic hazard at Diablo Canyon occurs from the possibility of an earthquake directly beneath the plant. Based on seismologic interpretations and conclusions from investigations of the 2003 San Simeon earthquake (magnitude 6.5) that occurred approximately 35 miles north of the Diablo Canyon site, the tectonic (geologic plate) setting where this earthquake occurred appears similar to the local tectonic setting of Diablo Canyon. The deep geometry of faults that bound the San Luis-Pismo structural block, where Diablo Canyon sits, is not understood sufficiently to rule out a San Simeon-type earthquake directly beneath the plant. It is necessary to better define the deep geometry of bounding faults of the San Luis-Pismo block and to better understand the lateral continuity of these fault zones. Although these fault zones are unlikely to replace the Hosgri Fault as the dominant source of seismic hazard at the plant, improved characterizations of these fault zones would refine estimates of the ground motion that is likely to occur at different frequencies. This information may be significant for engineering vulnerability assessments.

The Diablo Canyon seismic setting has been extensively studied, largely under PG&E's Long Term Seismic Program (LTSP), and PG&E continues to study it. Further study using advanced technology may help resolve remaining uncertainties. For example, high quality three-dimensional geophysical seismic reflection

mapping could resolve questions about the characterization of the Hosgri Fault and might change estimates of the seismic hazard at the plant. Similarly, direct imaging of the subsurface structure at Diablo Canyon could determine if faults exist near the site that do not break to the surface and could also serve to refine knowledge of the deep geometry, continuity, and interaction of poorly expressed faults that comprise the structural boundaries of the San Luis–Pismo Block. A permanent global positioning system (GPS) array, currently under development in the onshore region of the Diablo Canyon site, could refine models of tectonic block movements in the plant vicinity. Results of these surveys might alter fault parameters that are used in existing seismic hazard assessments.

Additional information on the seismic hazards at Diablo Canyon can be derived from the “Uniform California Rupture Forecast, Version 2 (UCERF-2)” database of faults and rupture probabilities in California, which was recently updated by the USGS, California Geological Survey, and the Southern California Earthquake Center. This database, used in conjunction with USGS models, would provide additional useful information regarding the seismic hazards at Diablo Canyon. To obtain accurate seismic hazard data, the USGS models must be modified to reflect site-specific conditions at the plants.

Finally, since Diablo Canyon was built, scientists have learned more about the ground motions that could result from an earthquake rupture. One important finding is that ground motion can be highly variable in the region near a rupture, with significant amplification of ground motion in some areas. This could be important at Diablo Canyon since the plant lies within five kilometers of the Hosgri Fault. PG&E is working collaboratively with the USGS to study earthquake hazards along the coastline in central and northern California, including the area surrounding Diablo Canyon.

Recommendations (p. 6)

The Energy Commission acknowledges PG&E’s ongoing efforts to understand the seismic hazards affecting the Diablo Canyon site through its Long Term Seismic Program (LTSP), and recommends that this work continue. As part of future IEPR assessments, beginning with the 2009 IEPR, PG&E should report to the Energy Commission on the overall status and results of its research efforts. As ground motion models are refined to account for a greater understanding of the motion near an earthquake rupture, it will be important for PG&E to consider whether the models indicate larger than expected seismic hazards at Diablo Canyon and, if so, whether the plant was built with sufficient design margins to continue operating reliably after experiencing these larger ground motions.

The California Energy Commission recommends that PG&E should use three-dimensional geophysical seismic reflection mapping and other advanced techniques to explore fault zones near Diablo Canyon. PG&E should report on their progress and their most recent seismic vulnerability assessment for Diablo Canyon in the 2009 IEPR. This action will supplement PG&E’s Long Term Seismic Program and help resolve uncertainties surrounding the seismic hazard at Diablo Canyon. Given the potential for an extended plant shutdown following a major seismic event, the Energy Commission, in consultation with appropriate state agencies, should evaluate whether these studies should be required as part of the Diablo Canyon license renewal feasibility study for the CPUC.



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October 22, 2008

ELECTRONIC DELIVERY

Barbara Byron
California Energy Commission
Attn: Docket No. 07-AB-1632-1
1516 Ninth Street, MS-36
Sacramento, CA 95814-5512

Re: ***PG&E's Comments on the Draft Committee Report
AB 1632 Assessment of California's Operating Nuclear
Power Plants, dated September 2008***

Dear Ms. Byron:

Attached are Pacific Gas and Electric Company's (PG&E) Comments on the Draft Committee Report, entitled "An Assessment of California's Nuclear Power Plants: AB 1632 Committee Report," dated October 2008. PG&E appreciates the opportunity to participate in the Commission's AB 1632 study process. We provided comments on the Study Plan, responded thoroughly to data requests, provided comments on the Draft Consultant Report and participated in all workshops including bringing experts to help assist the Committee in understanding PG&E's operations of the Diablo Canyon Power Plant. We have reviewed the Draft Committee Report and provide the attached comments and urge the Committee to make the modifications responsive to these comments in the final Committee Report. We also urge the Committee to direct that the Draft Consultant's Report be modified in accordance with our earlier submitted comments. Our comments can generally be divided into three categories; jurisdiction, the purpose and role of the feasibility study as it relates to the NRC and CPUC processes, and the difference between license renewal efforts and ongoing operational efforts.

In addition, PG&E would like to reiterate our comments stated at the October 20 workshop, that PG&E largely concurs with the recommendations and statements provided by the California Seismic Safety Commission in their letter dated October 17, 2008, and appreciates their thorough review and participation. We have additional comments on a few areas addressed in that letter which will be submitted under separate cover.

PG&E appreciates the opportunity to participate in the study process and looks forward to working with the Commission to ensure the Commission understands the important role of the Diablo Canyon Power Plant to the electricity system and its role in assisting California meet its greenhouse gas emission reduction targets.

Sincerely,

**AB 1632 NUCLEAR ASSESSMENT
COMMENTS ON DRAFT COMMITTEE REPORT**

INTRODUCTION

PG&E acknowledges the legitimate state interest in understanding and planning for emergency events that could result in the loss of energy supply from the State's two nuclear facilities and on that basis supported this AB 1632 study. However, care should be taken to develop recommendations that focus on the legitimate state interest underpinning the AB 1632 legislation and do not infringe upon the exclusive jurisdiction of the Nuclear Regulatory Commission (NRC).

As noted in the Committee Report, in its decision authorizing ratepayer funding of the license renewal feasibility study (D. 07-03-044), the CPUC directed PG&E to file an application submitting to the CPUC the final license renewal feasibility study addressing the cost-effectiveness of license renewal and whether license renewal is in the best interest of PG&E's ratepayers. The decision also directed PG&E to incorporate the findings and recommendations of the report issued by the CEC pursuant to AB 1632 in its feasibility study. PG&E does not interpret these directives to require PG&E to include in the license renewal feasibility study issues that are outside the scope of license renewal. Nor do they require PG&E to include in the CPUC application any showing on issues that are not within the CPUC's jurisdiction.

As PG&E set forth in the written and oral testimony supporting its request for ratepayer funding of the Diablo Canyon license renewal feasibility study, the issues addressed in the context of the feasibility study are specific to the question of whether Diablo Canyon can safely operate for an additional twenty years after the existing operating licenses expire in 2024 and 2025. By contrast, many of the items the Committee recommends including in the license renewal feasibility study are already being addressed in ongoing programs under the existing operating licenses. These efforts include: the analysis of seismic and tsunami hazards, emergency planning, and safety culture assessment all of which are directly relevant to the safe operation of Diablo Canyon under the current licenses and, more importantly, are subject to ongoing analysis, update and NRC review. As such, the license renewal feasibility study appropriately does not include analysis of these issues.

Finally, the Committee appears to be under the impression that "the CPUC will ... decide as part of PG&E's 2011 General Rate Case whether PG&E should pursue license renewal." (Report at p. 31) This is incorrect. In the Application referenced by the CEC, the CPUC will consider the cost-effectiveness and benefit to ratepayers of an additional 20 years of operation of Diablo Canyon.

We provide the following specific comments and suggested modifications to the recommendations consistent with these broad principles.

Recommendations 1-9

As described during these proceedings, PG&E is already committed to continue updating its knowledge of the seismicity surrounding the Diablo Canyon Site. PG&E is performing ongoing research and analysis as part of the long term seismic program, which is a requirement of the existing operating licenses for the plant. PG&E believes that it is relevant for the Commission to understand the seismic setting to help determine what generation planning efforts the Commission may undertake to prepare for such an unlikely event and will report its findings to the CEC as requested. However, these efforts should not be undertaken as part of PG&E's license renewal feasibility study.

In addition, as we discussed in our written and oral comments on the Draft Consultant Report, we believe there is no uncertainty regarding the seismic setting and hazard at the Diablo Canyon Site. While ongoing study to incorporate new information or techniques is prudent and will be undertaken to expand PG&E's knowledge base, we believe the characterization in both the Draft Consultant Report and the Committee Report that there are uncertainties understates the wealth of information already gathered and developed about the Diablo Canyon seismic setting. Therefore we recommend that the first sentence of the recommendation should be modified as follows:

The California Energy Commission, in cooperation with other appropriate state agencies and in coordination with PG&E, should evaluate the degree to which using three-dimensional geophysical seismic reflection mapping should be pursued, if warranted by a cost-benefit analysis, to supplement PG&E's ongoing seismic research programs ~~to resolve uncertainties surrounding the seismic hazard at Diablo Canyon.~~

Similarly, Recommendation 4 should be modified as follows:

The California Energy Commission, in cooperation with other appropriate state agencies, should consider the relevance of the USGS National Seismic Hazard Mapping Project models and the UCERF-2 database ~~in the context of the studies required as part of the license renewal feasibility assessment at Diablo Canyon for the CPUC. Updated seismic hazard analyses incorporating these inputs would provide additional information for regulators and the public regarding the seismic hazard at the plant site.~~

Calls heat up for reviews of California nuclear plants

Ken Bensinger and David Sarno, *Los Angeles Times*

March 21, 2011

Available online at: <http://articles.latimes.com/2011/mar/21/business/la-fi-cal-nukes-20110321>

State and federal officials are pushing for comprehensive checkups of the San Onofre and Diablo Canyon facilities, which have been cited repeatedly in recent years for safety lapses.

Pointing to Japan's nuclear crisis, state and federal officials have begun pushing for comprehensive reviews of California's two commercial nuclear plants, which are near powerful fault lines and have been cited repeatedly in recent years for safety lapses.

If reviewers identify new problems, it could lead to added safety measures — or potentially, delays or denials for renewals of the operating permits for the plants. The two plants, which have been online for decades, supply nearly 15% of the state's electricity.

"The fundamental question is whether these facilities should be located next to active faults and whether they are operated safely," said state Sen. Sam Blakeslee (R-San Luis Obispo), who holds a doctorate in geophysics. "With what's unfolding in Japan, why would anyone approve a permit for these plants to keep operating until every question is answered?"

Federal regulators have cited Southern California Edison's 2,350-megawatt San Onofre nuclear power plant near San Clemente dozens of times in recent years for safety violations that include failed emergency generators, improperly wired batteries and falsified fire safety data, records show.

At Pacific Gas & Electric's 2,240-megawatt Diablo Canyon facility on the Central Coast, inspectors in late 2009 found that safety valves designed to allow cooling water into the reactor core in emergencies had been stuck shut for 18 months.

In light of the crisis at Japan's Fukushima reactors, some state and federal lawmakers are now questioning whether the two utilities have underestimated the severity of earthquakes that could strike the plants.

Less than three years ago, a previously unknown fault was discovered within a mile of Diablo Canyon, and although regulators have asked the companies to conduct further seismic studies, neither has sought permits necessary to do so.

Edison has said that its facility, which houses two reactors, could withstand the equivalent of a magnitude 7 quake and is protected by a 30-foot seawall that is higher than the calculated maximum tsunami for the area.

PG&E, for its part, said that Diablo Canyon's two reactors could survive a magnitude 7.5 temblor, noting that it's built on a cliff 85 feet above sea level.

The reactors at these facilities are a different type — which experts say may be more robust — than the one at the Fukushima plant in Japan.

But some lawmakers and regulators point to the still-uncontrolled nuclear crisis in Japan after the massive quake and tsunami there as a strong justification for taking a hard look at the safety of this state's reactors and for possibly requiring additional retrofitting or even the eventual closure of the plants.

Blakeslee plans to ask PG&E to withdraw its application to the U.S. Nuclear Regulatory Commission to extend permits for its two reactors to operate until 2045 until further seismic studies are completed. Edison has not yet decided whether it would submit its own renewal application.

The NRC licenses each nuclear reactor separately. Licenses for the two reactors at Diablo Canyon expire in 2024 and 2025, while those for San Onofre both expire in 2022.

On Monday, the state Senate Select Committee on Earthquake and Disaster Preparedness will conduct a hearing on nuclear safety, focusing on lessons learned from Japan.

Last week, California's Public Utilities Commission said it was delaying an April hearing on extending the Diablo Canyon license to take into account events in Japan. And at the federal level, California's two senators asked the NRC last week to conduct a complete safety review of both facilities.

"Our two plants need immediate inspections and investigations, and they need to look at the increased risk of serious earthquakes, an increased risk of tsunamis and at the safety cultures at those plants," said Sen. Barbara Boxer (D-Calif.). She noted that more than 7 million people live within 50 miles of San Onofre, while nearly half a million are within that distance from Diablo Canyon.

In 2006, state lawmakers passed a bill calling on the California Energy Commission to review the safety at both plants; the commission in turn urged both utilities to conduct new high-tech surveys to update earthquake risk assessments.

San Onofre's chief nuclear officer, Pete Dietrich, said SCE was seeking more funds from the state before obtaining permits for new geological surveys. Dietrich said the utility hadn't decided whether it would apply to renew federal licenses for its two reactors.

Regarding Diablo Canyon, the PUC had asked PG&E to complete a thorough seismic review of the area before submitting its renewal application to the federal government.

But in 2009, PG&E applied to renew the licenses without having performed the new studies. The renewal application, which would allow the plant to operate until 2045, is now being considered by the NRC.

PG&E spokesman Paul Flake said that although the company began work on some new seismic surveys in January, it had not yet sought permits for the most conclusive testing urged by regulators.

"Our license renewal application and our seismic studies are two separate issues," Flake said.

Dan Hirsch, a nuclear policy lecturer at UC Santa Cruz and president of the Committee to Bridge the Gap, an anti-nuclear group, said California's reactors were built when the seismic risks involved were not well understood.

In Diablo Canyon's 1967 application to the PUC, PG&E said the site had only "insignificant faults that have shown no movement for at least 100,000 and possibly millions of years." Four years later, researchers discovered the Hosgri fault about three miles offshore, which led to expensive retrofitting of the plant.

In 2008, PG&E argued to the state Assembly that it had thoroughly reviewed its local geography and that no further seismic risks existed.

Yet weeks later, the U.S. Geological Survey revealed that it had found a second fault less than a mile from Diablo Canyon. That fault, called Shoreline, is thought by geologists to be capable of producing a magnitude 6.5 quake, while the Hosgri fault is rated up to 7.3.

Geophysicist Jeanne Hardebeck of the USGS helped discover the Shoreline fault. She said that the network of faults in the area appeared to be connected and that she feared a rupture at one could compound into a larger quake.

"There is a real issue of uncertainty when we put a magnitude on a fault," Hardebeck said, noting that the Japan quake occurred on a fault with a predicted maximum potential quake of magnitude 7.9, but in fact reached 9.

In its 2008 report, the California Energy Commission warned that San Onofre "could experience larger and more frequent earthquakes than had been anticipated when the plant was designed."

NRC spokesman Scott Burnell said that the quake risk at the two plants was acceptable. "All 104 licensed reactors in the country are meeting the agency's requirements to operate safely," he said.

Even so, NRC reports show that Diablo Canyon operated for 18 months with flawed valves that would have prevented cooling water from automatically flowing into the reactor core in an emergency. The problem was discovered in October 2009, and the NRC issued several sanctions against the plant.

The Union of Concerned Scientists, an environmental group, called the event a "near miss," singling it out as one of the most serious incidents at an American reactor in the last several years.

PG&E spokesman Flake contended that valves could still have been opened manually in an emergency. "PG&E has a very strong safety record," he said.

Preliminary report of the 2011 off the Pacific coast of Tohoku Earthquake

Excerpts from National Research Institute for Earth Science and Disaster Prevention (NIED) *Preliminary report of the 2011 off the Pacific coast of Tohoku Earthquake*, by Yoshimitsu Okada, President of NIED

Available online at: http://www.bosai.go.jp/e/international/Preliminary_report110328.pdf

Main shock (p. 1)

Main shock occurred on 14:46 of March 11, 2011 (JST). Seismic intensity of 7 in JMA (Japan Meteorological Agency) scale was recorded at Kurihara City, Miyagi Pref., and intensity of 6+ or 6- were observed in wide area along Pacific region ranging from Iwate Pref. to Ibaraki Pref.

Peak ground acceleration of 2,933gal (composite of three components) was observed at Tsukidate, Kurihara City, one of the NIED K-NET station.

It was the third time that intensity of 7 was recorded in Japan following the 1995 Kobe Earthquake (M7.3) and 2004 mid-Niigata Earthquake (M6.8). JMA named this earthquake "2011 off the Pacific coast of Tohoku Earthquake".

Hypocenter locates off Sanriku at 130km ESE of Oshika Peninsula with the focal depth of 24km. Magnitude of the earthquake was initially announced as M7.9 (Quick) by JMA and was revised to M8.4 (Prelim.) in 16:00 and M8.8 (Prelim.) in 17:30.

It was finally determined as M9.0 in March 13, CMT solution of this earthquake was thrust type with a pressure axis in WNW-ESE direction as shown in the inset of Fig.1. This means that this earthquake was generated as a typical inter-plate earthquake which is caused by the rebound of a continental plate (North American plate) against a subducting oceanic plate (Pacific plate) at Japan trench.

Tsunami (p. 3)

It is usual that an inter-plate earthquake occurred at trench region accompanies tsunami. Since the magnitude of this earthquake was as large as M9.0, the scale of generated tsunami was also huge one. In Japan, large tsunami attacked the Pacific coast ranging from Hokkaido to Okinawa and the tsunami was also observed at the coast of the Japan Sea, the Okhotsk Sea, and the East China Sea. The tsunami also propagated to the coast of Hawaii, northern and southern America continents, and the Pacific countries.

At Kamaishi, Ishinomaki, and Ofunato, the first arrival of tsunami was at 14:46, which means that the tsunami reached to these coastal cities at the same time of the earthquake occurrence. The tsunami of maximum height attacked these cities around 15:20, i.e. 30 minutes later of the earthquake. Fig.4 shows the distribution of maximum height of tsunami along the coast of the whole Japan. It was recorded more than 8.5m at Miyako, Iwate Pref., more than 8.0m at Ofunato, Iwate Pref., more than 7.3m at Soma, Fukushima Pref., 4.2m at Oarai, Ibaraki Pref., and so on.

Japan Meteorological Agency issued Tsunami Warning (Major tsunami) at 14:49, i.e. 3 minutes later of the earthquake, to Iwate, Miyagi, and Fukushima Prefectures. It was extended to Aomori, Ibaraki, and Chiba at 15:14, and was followed by Japan Sea side, Bonin Islands, Sagami Bay, Shizuoka and Wakayama

Prefectures. They were in series downgraded to Tsunami Warning (tsunami) and Tsunami Advisory for each region, and were completely cleared on 17:58, March 13.

Long-Term Forecasting (p. 7)

The Earthquake Committee of HERP (the Headquarters for Earthquake Research Promotion) has announced the Long-term Forecast about the occurrence potentials of subduction-zone earthquakes off the Pacific coast of the eastern Japan including the focal region of this M9.0 event.

The target area has been divided into the regions shown in Fig.10 and the estimated magnitude, occurrence probability within coming 30 years, and average recurrence interval have been estimated as in Table 1.

Table 1 Long-term forecast of subduction-zone earthquakes off the Pacific coast of Japan (HERP)

Region	Estimated magnitude	Occurrence probability within coming 30 years	Average interval
off northern Sanriku	~M8.0	0.5%~10%	~97 yrs
off central Sanriku	(cannot evaluate due to the lack of records)		
off southern Sanriku	~M7.7	80%~90%	~105 yrs
off Miyagi	~M7.5	if coupled 99%	37 yrs
off Fukushima	~M7.4 (multiple)	less than ~7%	> 400 yrs
off Ibaraki	M6.7~M7.2	more than ~90%	~21 yrs
off Boso	(cannot evaluate due to the lack of records)		
Trench zone	~M8.2(Tsunami Eq.)	~20%	~133 yrs
	~M8.2(Normal F. Eq.)	4%~7%	400~750 yrs

In “off Miyagi” region, six events were repeated in the past 200 years with average interval of 37.1 years. They occurred in 1793(M8.2; coupled), 1835(M7.3), 1861(M7.4), 1897(M7.4), 1936(M7.4), and 1978(M7.4), which results the occurrence probability of 99%, the highest value in Japan.

In this region, an earthquake of M7.2 has occurred in August, 2005. Since the M was less than estimated level of M7.5, it was evaluated that we cannot ease up our attention to this region.

Next, an earthquake of M7.3 occurred in the region of “off southern Sanriku” on March 9, two days before the M9.0 event. This time, there was an opinion that the occurrence probability of the coupled event of “off Miyagi” and “off southern Sanriku” may be lowered.

However this was a foreshock of the M9.0 event and the main shock involved five regions from “off central Sanriku” to “off Ibaraki” as well as “trench zone”.

Historically, it was known that a great earthquake associated with huge tsunami occurred in 869 (Jogan) in Heian Era and killed more than 1,000 people at Tagajo, Miyagi Prefecture. But one could hardly imagine that such a event would recur nor the greater event would happen in the land of the living.

“It was like pulling teeth.”

Oversight—and Oversight—in Regulating Deepwater Energy Exploration and Production in the Gulf of Mexico

Excerpts from the *National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, Chapter 3*

Available online at: http://www.oilspillcommission.gov/sites/default/files/documents/4_OSC_CH_3.pdf

The Deepwater Horizon rig sank on April 22, 2010, two days after the Macondo well blowout and explosion that killed 11 workers. Not long after the tragedy, its repercussions shifted to the Minerals Management Service (MMS), the federal agency responsible for overseeing the well’s drilling and operation. Nineteen days after the rig sank, Secretary of the Interior Ken Salazar announced his intention to strip MMS’s safety and environmental enforcement responsibilities away from its leasing, revenue collection, and permitting functions, and to place the former within a “separate and independent” entity. A week later, he announced MMS would be reorganized into three separate entities with distinct missions: a Bureau of Ocean Energy Management; a Bureau of Safety and Environmental Enforcement; and an Office of Natural Resources Revenue.² And, by June 19, the Secretary had discarded the “MMS” name altogether.³ Like the Deepwater Horizon, MMS had ceased to exist. (pg. 1)

The Macondo Well

NEPA. MMS performed no meaningful NEPA review of the potentially significant adverse environmental consequences associated with its permitting for drilling of BP’s exploratory Macondo well. MMS categorically excluded from environmental impact review BP’s initial and revised exploration plans—even though the exploration plan could have qualified for an “extraordinary circumstances” exception to such exclusion, in light of the abundant deep-sea life in that geographic area and the biological and geological complexity of that same area. MMS similarly categorically excluded from any NEPA review the multiple applications for drilling permits and modification of drilling permits associated with the Macondo well. The justification for these exclusions was that MMS had already conducted NEPA reviews for both the Five-Year Program and the Lease Sale that applied to the Macondo well. The flaw in that agency logic is that both those prior NEPA reviews were conducted on a broad programmatic basis, covering huge expanses of leased areas of which the Macondo well was a relatively incidental part. Neither, moreover, included a “worst case analysis” because the President’s Council on Environmental Quality had eliminated the requirement for such analysis under NEPA for all federal agencies in 1986. As a result, none of those prior programmatic reviews carefully considered site-specific factors relevant to the risks presented by the drilling of the Macondo well.*

Oil Pollution Act of 1990 and Oil Spill Response Plans. Under the Oil Pollution Act of 1990, as supplemented by a Presidential Executive Order, MMS is responsible for oilspill planning and preparedness as well as select response activities for fixed and floating facilities engaged in exploration, development, and production of liquid hydrocarbons and for certain oil pipelines. The agency requires all owners or operators of offshore oil-handling, storage, or transportation facilities to prepare Oil Spill Response Plans. MMS regulations detail the elements of the response plan (an emergency-response action plan, oil-spill response equipment inventory, oil-spill response contractual agreements, a calculation of the worst-case discharge scenario, plan for dispersant use, in-situ burning plan, and information regarding oil-spill

response training and drills). The emergency response plan is supposed to be the core of the overall plan, and in turn is required to include information regarding the spill-response team; the types and characteristics of oil at the facilities; procedures for early detection of a spill; and procedures to be followed in the case of a spill.

But neither BP, in crafting its Oil Spill Response Plan for the Gulf of Mexico applicable to the Macondo well, nor MMS in approving it, evidenced serious attention to detail. For instance, the BP plan identified three different worst-case scenarios that ranged from 28,033 to 250,000 barrels of oil discharge and used identical language to “analyze” the shoreline impacts under each scenario. To the same effect, half of the “Resource Identification” appendix (five pages) to the BP Oil Spill Response Plan was copied from material on NOAA websites, without any discernible effort to determine the applicability of that information to the Gulf of Mexico. As a result, the BP Oil Spill Response Plan described biological resources nonexistent in the Gulf—including sea lions, sea otters, and walruses.

Even more troubling, the MMS Gulf of Mexico Regional Office approved the BP plan without additional analysis. There is little in that approval to suggest that BP and MMS gave close scrutiny to the contents of the Oil Spill Response Plan. The Regional Office’s routine practice was to review and approve oil-spill response plans within 30 days of their receipt. Absent any legal requirement to do so, the office did not distribute submitted plans to other federal agencies for review or comment, nor did it seek public review or comment.

The inescapable conclusion is striking, and profoundly unsettling. Notwithstanding statutory promises of layers of required environmental scrutiny—by NEPA, the Magnuson-Stevens Act, the Outer Continental Shelf Lands Act, and the Oil Pollution Act—and the potential application of some of the nation’s toughest environmental restrictions—the Endangered Species Act and Clean Water Act—none of these laws resulted in site-specific review of the drilling operations of the Macondo well. The agency in charge, MMS, lacked the resources and committed agency culture to do so, and none of the other federal agencies with relevant environmental expertise had adequate resources or sufficient statutory authority to make sure the resulting gap in attention to environmental protection concerns was filled.

Federal oversight of oil and gas activities in the Gulf of Mexico—almost the only area where substantial amounts of drilling were taking place—took a generally minimalist approach in the years leading up to the Macondo explosion. The national government failed to exercise the full scope of its power, grounded both in its role as owner of the natural resources to be developed and in its role as sovereign and responsible for ensuring the safety of drilling operations. Many aspects of national environmental law were ignored, resulting in less oversight than would have applied in other areas of the country. In addition, MMS lacked the resources and technical expertise, beginning with its leadership, to require rigorous standards of safety in the risky deepwater and had fallen behind other countries in its ability to move beyond a prescription and inspection system to one that would be based on more sophisticated risk analysis.

In short, the safety risks had dramatically increased with the shift to the Gulf ’s deepwaters, but Presidents, members of Congress, and agency leadership had become preoccupied for decades with the enormous revenues generated by such drilling rather than focused on ensuring its safety. With the benefit of hindsight, the only question had become not whether an accident would happen, but when. On April 20, 2010, that question was answered. (pgs. 82-85)